

Small Animal Pacemaker

Progress Report

Group SD1305

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April 9, 2013

## **Introduction:**

The pacemaker is a medical device that is used to regulate the beating of the heart by using electric pulses that are transported from the body of the device to its leads. The leads are attached to the right ventricle and left atrium wall respectively. The animals that this device will be implanted into are called knockout mice. These knockout mice are genetically engineered to have a gene altered with one that causes heart disease. The pacemaker would control the hearts and act as cardiovascular research device. Below are our current basic requirements:

- Rate adjustable DOO type pacemaker small enough to implant within a rat or mouse
- Working budget of \$200
- Target outer diameter of 7mm, Target length of 9mm, and Target volume of 0.5 mL
- Battery operated
- 4-8 week battery life
- Two unipolar electrode leads capable of both pacing the heart
- Pace at least twice the average mouse heart rate of 700 bpm (beats per minute)
- Adjustable pacing threshold voltage of 0.5V-3V
- Material used must be biocompatible to not harm the patient mouse or rat
- Acute animal experiment

## **Current Status:**

As of now, we have a preliminary version of software that outputs a square wave on two pins with adjustable frequency by slightly changing the code. We also have maximum power calculations of all of our components to compute the energy capacity needed for the battery. Although we have changed the requirement to not sense the heart, we have ECG circuitry designed and built that could be used for signal acquisition. Finally, we have designed an experiment that will allow us to determine the electrical characteristics of mice hearts and help us determine the optimum fixation device among hook, plunge, and corkscrew.

## **Goals:**

We plan to perform our experiment, analyze the data from that experiment, and use that to determine the next steps regarding lead design, appropriate pacing voltage, and power consumption. We also plan to travel to the Sanford Cardiovascular Research Lab in Sioux Falls,

SD to test a benchtop prototype in mice. We will have to build this prototype before then using what we have designed so far and the data we have collected from our experiment. This will be the main obstacle we will face to achieve our goals for this semester. If we experience difficulty with the benchtop prototype we will use a high-end programmable signal generator to gather more data regarding the mice hearts' characteristics under pacing signals.